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09/351,892	07/13/1999	ELWIN M. BEATY	2371	1396

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EXAMINER	
CHAWAN, SHEELA C	
ART UNIT	PAPER NUMBER
2625	

DATE MAILED: 08/15/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/351,892	BEATY ET AL.	
	Examiner	Art Unit	
	Sheela C Chawan	2526	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *23 May 2003* .

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1- 29,33-66* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☒ Claim(s) *30* is/are allowed.

6)☒ Claim(s) *1-29 and 33-66* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *23 May 2003* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

DETAILED ACTION

Response to Amendment

1. Applicant's arguments filed on May 23, 2003 (paper # 15/B) have been fully considered but are deemed to be moot in view of the new grounds of rejection .

RCE

2. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after allowance or after an Office action under *Ex Parte Quayle*, 1935 Comm'r Dec. 11 (1935). Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, prosecution in this application has been reopened pursuant to 37 CFR 1.114. Applicant's submission filed on 5/23/03 has been entered.

Drawings

3. Drawings filed on this 5/23/03 have been approved by the draftsperson .

Claim Objections

4. Claims 31 and 32 are objected to under 37 CFR 1.75(c), as being of improper dependent form for failing to further limit the subject matter of a previous claim. Applicant is required to cancel the claim(s), or amend the claim(s) to place the claim(s) in proper dependent form, or rewrite the claim(s) 31 and 32 in independent form.

Dependent claims 31 and 32 recite limitation that are already included in independent claim 30, which they depended from .

Claim Rejections - 35 U.S.C. § 103

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103© and potential 35 U.S.C. 102(f) or (g) prior art under 35 U.S.C. 103(a).

Claims 1,4, 9, 10,12-29 are rejected under 35 U.S.C. 103(a) as being unpatentable over Suzuki et al. (US.6,307, 210) in view of Toh (US.6,141,040) .

As per claim 1, Suzuki discloses an apparatus for three dimensional inspection of an electronic part, wherein the apparatus is calibrated using a precision pattern mask

with dot patterns deposited on a calibration transparent reticle, the apparatus for three dimensional inspection of an electronic part comprising:

(a) a camera (fig 2a 1, column 2, line 62) and an illuminator for imaging the electronic part (column 2, line 65, column 9, lines 52-56, fig 14, 20 and 22) , the camera being positioned to obtain a first view of the electronic part (note, fig 2a element 1 camera taking image of first view of electronic part is considered to be upper surface image of an IC package to be imaged) ;

(b) a means for light reflection (fig 14, 20 and 22), positioned to reflect a different view of the electronic part into the camera, wherein the camera provides an image of the electronic part having differing views (column 4, lines 1-27) ; and

Suzuki discloses device for imaging object to be inspected and device for inspecting semiconductor package, but fails to specifically mention about an image processing of the electronic part that applies calculation on the differing views of the image to calculate a three dimensional position of at least one portion of the electronic part . However, Toh discloses measurement and inspection of leads on integrated circuit packages . The system comprises :

a means for image processing the image of the electronic part that applies calculation on the differing views (column 3, lines 15-33) of the image to calculate a three dimensional position of at least one portion of the electronic part (fig 7, column 6, lines 20- 50) . It would have been obvious to one with ordinary skill in the art at the time of invention to incorporate the teaching of means for calculating a different views of the image using three - dimensional position of at

least one portion of the electronic part as taught by Toh 's into the system of Suzuki . The motivation for doing so is to analyze images of three dimensional position of each lead can be accurately computed and major lead defects can be inspected as suggested by Toh at (column 3, lines 20- 22).

As per claim 4, Suzuki discloses apparatus wherein the means for light reflection further comprises a prism (column 8, lines 65- 67).

As per claim 9, Toh discloses the apparatus wherein the means for imaging provides the image to a frame grabber board (column 4, lines 30- 37) .

As per claim 10, Toh discloses the apparatus wherein the frame grabber board provides an image data output to a processor to perform a three dimensional inspection of a part (column 3, lines 20- 33, column 4, lines 65-67) .

As per claim 12, Suzuki discloses the apparatus wherein a maximum depth of focus of a side perspective view (column 2, lines 35-39) allows for a fixed focus system to inspect larger electronic parts (column 3, lines 6-18) , with one perspective view imaging one portion of the electronic part and a second perspective view imaging a second portion of the electronic part (column 3, lines 6-18, column 4, lines 1 - 30) .

As per claim 13, Suzuki discloses the apparatus wherein a maximum depth of focus of a side perspective view includes an area of the electronic part including a center row of balls (column 13, lines 53-68, column 14, lines 1-7) .

As per claim 14, Suzuki discloses the apparatus wherein all of the balls on the electronic part are in focus resulting in two perspective views for each ball (column 14, lines 1-7).

As per claim 15, Suzuki discloses apparatus means for inspecting gullwing and J lead devices (column 6, lines 48-51) .

As per claim 16, Suzuki teaches a method for three dimensional inspection of a lead on a part, the method comprising the steps of:

(a) using a camera to receive an image of the lead (fig 2(a)) ;

(c) providing fixed optical elements to obtain a side perspective view of the lead (column 4, lines 20-26) ;

(f) processing the pixel values with the processor to calculate a three dimensional position of the lead (column 14, lines 1-7).

Suzuki discloses device for imaging object to be inspected and device for inspecting semiconductor package, but fails to specifically mention about transmitting the image of the lead to a frame grabber . However, Toh discloses measurement and inspection of leads on integrated circuit packages . The system comprises :

(b) transmitting the image of the lead to a frame grabber (column 4 , lines 30-34) ;

(d) transmitting the side perspective view of the lead to the frame grabber (column 4 , lines 30- 34) ;

(e) operating a processor (column 4 , lines 33 -34) to send a command to the frame grabber to acquire images of pixel values from the camera (column 4, lines 9- 37). At the time of invention , it would have been obvious to one with ordinary skill in the art to incorporate the teaching of transmitting the image of the lead to a frame grabber as taught by Toh's into the system of Suzuki . The motivation for doing so is to

digitalizes and analyses the image respectively as suggested by Toh at (column 4, lines 20- 22).

As per claim 17, Suzuki discloses method wherein the step of processing the pixel values further comprises determining state values from the part itself (column 12, lines 20-67) .

As per claim 18, Toh discloses the method wherein the lead is a curved surface lead (column 1, lines 24- 28) .

As per claim 19, Suzuki discloses method wherein the lead is a ball (column 13, lines 59-67).

As per claim 20, Suzuki discloses the method wherein the part is a ball grid array (column 13, lines 53-67).

As per claim 21, Suzuki discloses device for imaging object to be inspected and device for inspecting semiconductor package. Suzuki is silent about the processor which processes the pixel values to find a rotation, an X placement value and a Y placement value of the part relative to world X and Y coordinates. However , Toh discloses method wherein the processor processes the pixel values to find a rotation, an X placement value and a Y placement value of the part relative to world X and Y coordinates by finding points on four sides of the part (column 6 , lines 20- 63) .

As per claim 22, Toh discloses the method further comprising the steps of:

(a) using a part definition file that contains measurement (column 6 , lines 20- 63) values for an ideal part (column 1, lines 29- 37, column 2, lines 9- 20) ;

(b) calculating an expected position for each lead of the part for a bottom view , using the measurement values from the part definition file and the X placement value and Y placement value (column 1, lines 29- 37, column 2, lines 9- 20, column 3, 20- 41, column 6 , lines 20- 63) .

As per claim 23, Toh discloses method comprising the step of using a search procedure on the image to locate the lead (column 6, lines 7- 63) .

As per claim 24, Toh discloses method comprising the step using a sub pixel edge detection method to locate a reference point on each lead (column 6, lines 7- 63) .

As per claim 25, Toh discloses method further comprising the step of determining a lead center (column 6, lines 20- 63) location and a lead diameter (column 6, lines 20- 43) in pixels and storing , the lead center location and lead diameter in memory (column 5, lines 1- 8) .

As per claim 26, Toh discloses method of calculating an expected position of a center of each lead (column 6, lines 7- 36) in the side perspective view in the image using a known position of the side perspective view (column 3, lines 11-33 , column 4, lines 9-20) from calibration (column 3, lines 40- 64, column 4, lines 41-68) .

As per claim 27, Toh discloses method of converting the pixel values into world locations by using pixel values and parameters determined during calibration wherein the world locations represent physical locations of the lead with respect to world coordinates defined during calibration (column 6, lines 7- 63).

As per claim 28, Toh discloses method wherein a Z height of each lead is calculated in world coordinates in pixel values by combining a location of a center of a lead from a bottom view with a reference point of the same lead from a side perspective view (column 6, lines 20- 63).

As per claim 29, Toh discloses method of converting the world coordinates to part values using a rotation, X placement value and Y placement value to define part coordinates for an ideal part where the part values represent physical dimensions of the lead including lead diameter, lead center location (column 6, lines 20- 43) in X part and Y part coordinates and lead height in Z world coordinates (column 5, lines 58- 67, column 6, lines 1 - 63).

6. Claims 2, 3, 5-11, are rejected under 35 U.S.C. 103(a) as being unpatentable over Suzuki et al. (US.6,307, 210) in view of in view of Toh (US.6,141,040) , as applied to the above claims 1, 4, 12-29, and further in view of King et al.(US.6, 236, 747) .

Regarding claim 2, Suzuki discloses device for imaging object to be inspected and device for inspecting semiconductor package, but fails to specifically mention about illuminator comprises a ring light . However, King discloses system and method for image subtraction for ball and bumped grid array inspection where the ring illumination apparatus 20 includes a substantially ring -shaped light source 24 that generates light beams and directs the light beams into the field of view on the article , column 5, lines 41- 58). It would have been obvious to one with ordinary skill in the art at the time of invention to incorporate the teaching of an illuminator comprises a ring light as taught

by King 's into the system of Suzuki . The motivation for doing so is to detect quickly and accurately detects absence/presence of the illuminated reflective elements , determines their position , and measures the size and shape , e.g. the diameter and circularity of any protruding object, if desired, as suggested by King at (column 3, lines 11- 15).

As per claim 3, King teaches the apparatus of claim 1 wherein the means for light reflection further comprises a mirror (column 9, lines 54- 58) .

As per claim 5, King teaches the apparatus of claim 1 wherein the means for light reflection further comprises a curved mirror (column 9, lines 55-58) .

As per claim 6, King teaches the apparatus of claim 1 wherein the electronic part further comprises a ball grid array (column 5, lines 27-30) .

As per claim 7, King teaches the apparatus of claim 6 wherein the electronic part further comprises balls on a wafer (column 5, lines 27-30) .

As per claim 8, King teaches the apparatus of claim 6 wherein the electronic part further comprises balls on a die (column 10, lines 25-29) .

As per claim 9, King teaches the apparatus of claim 1 wherein the means for imaging provides the image to a frame grabber board (note, CCD is considered to be frame grabber , column 5, lines 59-68) .

As per claim 10, King teaches the apparatus of claim 9 wherein the frame grabber board provides an image data output to a processor to perform a three dimensional inspection of a part (column 12, lines 45 - 67, column 13, lines 1-5) .

As per claim 11, King teaches the apparatus of claim 1 further comprising a nonlinear optical element to magnify the image in one dimension (column 15, lines 26-35).

7. Claims 33 - 49, 56– 66, are rejected under 35 U.S.C. 103(a) as being unpatentable over Toh (US.6,141,040) in view of Kaplan et al. (US.6,096,567) .

As per claim 33, Toh discloses a method for three dimensional inspection of a lead on a ball array device the method comprising (abstract, column 1, lines 17- 37):

illuminating the lead (column 3, lines 42- 57) ;

providing fixed optical elements to obtain both-a bottom view of the lead and a side perspective view of the lead (column 1, lines 29- 37, 60- 67, column 3, lines 42-57, column 4, lines 21- 38, column 5, lines 9- 21);

receiving at least the bottom view and the side perspective view of the lead using a camera (column 1, lines 29- 37, 60- 67, column 3, lines 42- 57, column 4, lines 21-38, column 5, lines 9- 21) ;

transmitting the bottom view and the side perspective view of the lead to memory as pixel values (column 4 , lines 21- 37, column 5, lines 10- 39) ;

determining a first lead reference pixel position in the bottom view (column 1, lines 29- 37, 60- 67, column 3, lines 42- 57, column 4, lines 21- 38, column 5, lines 9-21);

determining a second. lean reference pixel position in the side view (column 1, lines 29- 37, 60- 67, column 3, lines 42- 57, column 4, lines 21- 38, column 5, lines 9-21);

Toh discloses measurement and inspection of leads on integrated circuit packages, Toh fails to specifically mention about converting the first and second lead reference pixel positions into a world value by using pixel values and parameters determined during a calibration . However, Kaplan discloses method and apparatus for direct probe sensing . The system comprises :

converting the first and second lead reference pixel positions into a world value by using pixel values and parameters determined during a calibration (column 7, lines 3-60 , column 9, lines 14- 59 , column 10, lines 16- 53) . It would have been obvious to one with ordinary skill in the art at the time of invention to incorporate the teaching of step converting the first and second lead reference pixel positions into a world value by using pixel values and parameters determined during a calibration as taught by Kaplan 's into the system of Toh . The motivation for doing so is to automatically determine the position coordinates of a probe array and the position coordinates of a first die with sufficient accuracy (column 3, lines 26- 32), as suggested by Kaplan at (column 3 , lines 29- 32).

As per claim 34, Toh discloses the method of claim 33, wherein illuminating the lead is achieved using a single light source (column 3, lines 42- 57) .

As per claim 35, Toh discloses (New) the method of claim 33, wherein illuminating the lead is achieved using more than one light source (column 3, lines 42- 57) .

As per claims 36 and 37, Toh discloses the method of claim 33, wherein the bottom view of the lead and a side perspective view of the lead are obtained in a single image (column 2, lines 38- 41, 45- 47, column 3, lines 15- 33, column 6, lines 20- 50) .

As per claim 38, Kaplan discloses the method wherein the parameters determined during the calibration (column 7, lines 3-60 , column 9, lines 14- 59 , column 10, lines 16- 53) are selected from the group consisting of: pixel scale factors (column 8, lines 43- 65), an angle at a particular point in a view (column 2, lines 4- 29) , and correspondence of one or more pixel values to world values (column 7, lines 3 - 60 , column 12, lines 5 - 22) .

As per claims 39 and 56, Kaplan discloses the method of claim 33, wherein the calibration includes resolving missing state values of an inspection system by imaging a precision pattern of known dimensions (column 2, lines 52- 62), and spacing (column 22, lines 34- 44, column 25, lines 1 - 10) .

As per claims 40 and 57, Kaplan discloses the method of claim 33, wherein the calibration includes determining and storing pixel values of features of a precision pattern of known dimensions and spacing (column 2, lines 52- 62), and spacing (column 22, lines 34- 44, column 25, lines 1 - 10) .

As per claims 41 and 58, Kaplan discloses the method of claim 33, wherein the calibration includes determining and storing deviations (column 14, lines 38- 48), from ideal world locations of features of a precision pattern of known dimensions and spacing (column 7, lines 3 - 60, column 19, lines 3- 44) .

As per claims 42 and 59, Kaplan discloses the method of claim 33, wherein a Z value is calculated by combining a deviation (column 14, lines 38- 65), of the first lead reference pixel position (column 6, lines 23- 67) , from its ideal position with a deviation of the second lead reference pixel position from its ideal position (column 7, lines 21- 60, column 12, lines 4- 65) .

As per claims 43 and 60, Kaplan discloses the method of claim 33, further comprising: converting world values to Z deviations (column 14, lines 38- 65) by calculating deviation values that represent the deviation of the lead from its ideal position (column 7, lines 21- 60, column 12, lines 4- 65).

As per claims 44 and 61, Toh discloses the method of claim 33, further comprising:

converting world values to coplanarity (column 3, lines 34 - 41) values by calculating deviation values that represent the deviation of the lead from a reference plane (column 3, lines 20- 67, column 4, lines 1- 8, column 6, lines 1 - 63).

As per claims 45 and 62, Toh discloses the method of claim 33, further comprising: converting world values to coplanarity values by calculating deviation values that represent the deviation of the lead from a seating plane (column 3, lines 34- 67, column 4, lines 1 - 8) .

As per claims 46 and 63, Toh discloses the method of claim 33, where the illuminating is with a diffuse light (lighting provided on the work-plane or on an the object light that is not incident predominantly from any particular direction , fig 3a, item 5 , column 3, lines 11- 33, column 4, lines 21 - 37, column 5, lines 9- 21).

As per claims 47, 48 and 64 Toh discloses the method of claim 33, wherein the illuminating is with a diffuse light for the bottom view of the lead (lighting provided on the work-plane or on an the object light that is not incident predominantly from any particular direction , fig 3a, item 5, column 3, lines 11- 33, column 4, lines 21 - 37, column 5, lines 9- 21) .

As per claim 65, Toh discloses the method of claim 33, wherein the illuminating with a diffuse light for the side perspective view of the lead (column 3, lines 10- 41, column 5, lines 28- 31, column 6, lines 20- 36) .

As per claims 49 and 66, Toh discloses the method of claim 33, wherein the. illuminating is with an overhead reflective diffuser (column 3, lines 10- 41, column 5, lines 28- 31, column 6, lines 20- 36) .

Reason For Allowance

8. The following is an examiner's statement of reasons for allowance:

The prior art of record including Suzuki (US.6,307,210), Nayar (US. 4,893,183) fails to teach or suggest, alone or in combination, a method for three dimensional inspection of a lead on a part, the method comprising the steps of " converting the pixel values into world locations by using pixel values and parameters determined during calibration wherein the world locations represent physical locations of the lead with respect to world coordinates defined during calibration , wherein a Z height of each lead is calculated in world coordinates in pixel values by combining a location of a center of a lead from a bottom view with a reference point of the same lead from a side perspective view , converting the world coordinates to part values using a rotation, X

placement value and Y placement value to define part coordinates for an ideal part where the part values represent physical dimensions of the lead including lead diameter, lead center location in X part and Y part coordinates and lead height in Z world coordinates, and comparing ideal values defined in a part file to calculate deviation values that represent a deviation of the center of the lead from its ideal location ", as recited in the independent claim 30 and in combination with other elements of the claim .

9. Claim 30 is allowed.

Contact Information

10. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Sheela C Chawan whose telephone number is 703-305- 4876. The examiner can normally be reached on Monday through Thursday 7.30 a.m. to 6.00 p.m.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Bhavesh Mehta, can be reached on (703) 308 - 5246. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9314.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-305-9700.

Jayanti K. Patel
Primary Examiner

SCC
Sheela Chawan
Patent Examiner
Group Art Unit 2625
August 7, 2003